Science with Handhelds – Joellen Dodds

Narrative description of how you use technology in the classroom in innovative ways.

Our community college, the College of Southern Idaho, just held their annual Girls in Technology Day. Their objective is to expose girls to nontraditional career opportunities in the science, math and technology fields. I had the opportunity to accompany groups on their field trip to the hospital and the veterinary technology program. Students were shown some of the types of imagery used in the medical fields and told about the new innovations in 3D viewing of organs such as the heart. The technician talked about being able to measure areas of the heart that had been affected by a heart attack. Of course, these experiences are valuable as our students prepare for continuing education after high school.

Last weekend at Micron, I participated in a class for teachers, *Engineering the Future*, that gave us hands-on activities and insights into the need for the integration of science, math, and technology. It is through these experiences and others that continue to emphasize to me that our students need to have real life experiences using appropriate technology that will allow them to mirror what professionals use in their work place.

In class, I have my students use reflectance spectrometers to create a graph and 'signature' of a variety of materials. The graphs include the reflectance data from the visible and infrared wavelengths. Afterwards, we look at other reflectance graphs plotted from current data obtained from orbiters at Mars. By using our spectrometers, students can have a firmer understanding of how scientists can say, for example, that there is hematite on Mars.

My students use a geographic information system software, ArcView, to map their water quality study area. Along with their data, they use GPS units to geo reference where they did their study. The GIS program allows them to find patterns within the chemical and physical parameters. This water quality study has been ongoing for over a decade and has evolved over the years to include all earth science students. The actual water data collection day is a team effort (science, math, geography/social studies, English, speech, and reading) which also includes community members sharing their expertise in soils, plants, and land use. The water data is obtained by using water chemical kits from Hach and LaMotte.

Students use probeware to collect data such as temperature data in weather inquiries or to examine differential heating. The software that is available allows students to have their real time graphs to analyze. A traditional activity may have used thermometers with students recording data every few seconds or minutes. With the probeware and software, the collecting and recording of the data is done accurately and students can spend more time analyzing data.

We have a seismometer in the room which displays world-wide earthquakes as they occur on a computer monitor. This display was quite exciting when we came back from Christmas break to see the seismic waves from the Sumatra earthquake. The software program allows students to enlarge the seismic waves to examine for P and S waves.

Students have accessed Mt.Wilson Observatory's teaching scope through a program called TIE. Specific software downloads images which students have taken with the camera attached to the telescope. Being able to do this remotely in a warm room in the winter is quite amazing!

Students frequently use the computers for specific programs such as SeisVolE, an earthquake program, or for graphing data using Excel or creating their reports in Word or presentations in PowerPoint. I want students to be able to use the most appropriate tool for learning whether it is the computer and software, a calculator, a GPS unit, or probeware.

Narrative description of how your use of technology in the classroom has impacted student performance.

Engaging students involves using a variety of learning strategies. In my experience as an educator, students learn best when they make their own discoveries or answer their own questions. Using technology, where appropriate, enhances the discovery process.

Right now in my science classes, students are using the Internet for researching current Mars exploration data. This information is not in any textbook. Along with collecting and analyzing information to answer their questions, students are learning about reliable sources, how to reference sources, and how to create a presentation with images, animations, and hyperlinks. Learning how to use a specific software was not the primary objective, but as students begin to use the technology, their experiences increase. After presenting their research, students will all have the advantage of current information and know how to access the information.

Having a seismometer in the classroom has added interest in earthquakes beyond just the unit of study on earthquakes. Students and adults frequently check out the computer display. The software can be manipulated to show incoming seismic waves so they can be measured. Accessing other seismic displays of the same event on the Internet can allow students to triangulate and find the epicenter. This is real-time data and it can be analyzed in our classroom!

Using GPS units to obtain latitude and longitude reading can be useful for collecting data for student projects but also acquaint students with technology that is more commonly being used in every day life. The GPS units have been used in geocaching activities on campus to introduce students to the basic uses. But the GPS units are primarily used so that project data can be imported into the GIS (geographic information systems) software, ArcView, and mapped. This is software that I want all students to use and know basic skills. Being able to query data is a powerful aspect of this software. I plan computer lab time periodically throughout the school year to use ArcView such as worldwide earthquake data, GLOBE weather data, and our own project data. There is much more of a learning impact to analyze a thousand or more earthquake events from the past month than trying to plot 40-50 of them by hand on a map. The sheer numbers of events that the GIS software can display can allow students to make the observations of the data that they wouldn't be able to do with hand plotting. Combine the earthquake events with active volcanoes and plate boundaries and the patterns start popping out. Students understand the relationships. This use of technology has enhanced students' learning as no other activity or groups of activities did in the past.

Using thermometers to measure differential heating can take a lot of class time and the data collection may not be the most accurate. Using temperature probes for the same activity will produce accurate data. Also, the emphasis of the activity shifts to data analysis and an increased understanding of the concept. Students learn how to use appropriate tools to find answers and these tools, such as probeware, are ones that are used in the business world. Student performance always improves when students are engaged in their learning.

Budget narrative of what you are proposing to purchase for use in the classroom.

1. The PalmOne Tungsten T5 is a handheld computer that can be interfaced with the Vernier Lab Pro and probeware. I already have fifteen Vernier Lab Pro units and a variety of Vernier probes. Fifteen Tungsten T5 handheld units will allow group sizes to be no more than two to three students. The Tungsten T5 is also capable of being fully integrated with the Vernier software.

Each handheld unit cost $399. The PalmOne website is advertising a $50 rebate from authorized dealers. This rebate does have a summer deadline. I have never worked with a rebate offer through a school order, but this could be a potential savings of $750. I did not include it since there were too many unknowns (ordering timeline, school district policy). Shipping and handling was not added to the budget because I have worked with dealers who will ship free to educational institutions.

2. The hard case for the Tungsten T5 is $40. The case is an accessory but in a classroom environment, I believe it will be essential to have a protective covering for each handheld unit.

3. The Vernier package includes the cradle, software for the handheld and connecting cable. The cradle will allow the handheld unit to be secured to the Lab Pro while still allowing access to the data ports on the Lab Pro. The software will be necessary to load onto each handheld to allow interfacing of the two units. The cable will also be necessary to connect the handheld to the Lab Pro. I called Vernier tech support and they estimated this new package for the Tungsten T5 to be $70.

4. Workshops are periodically given at Vernier (Beaverton, Oregon) or at other sites throughout the United States. The closest for me would be Beaverton, Oregon in August. This would be a one day workshop to use the Tungsten T5 handhelds with probes. I plan to drive from Twin Falls and stay with family in Portland. The workshop would get me ready for using the handheld units in the classroom. I have used Vernier probes in the classroom and am familiar with the older software, but this workshop should bring me ‘up to speed’ with the Tungsten T5 and the newer software.

5. As in the agreement, I will present what I am doing in the classroom with the handheld units and Qwest Foundation Grant opportunity at the Idaho Science Teachers Association Fall Conference in October, 2005, in Pocatello. The budget items would pay for the expenses anticipated for this conference. I always attend the conference, so the budget items should be close to actual expenses.

Narrative description of how what you are proposing to purchase will enhance your teaching in the classroom.

My proposal for purchasing Palm Tungsten T5 units revolves around giving students more opportunities for inquiry on which to build new knowledge within the framework of our State and District Standards. Student generated questions and student designed experiments are integral to the scientific process and need to be encouraged within each science discipline. These experiences help students to acquire concepts of science instead of just knowing facts.

For over a decade I have been asking my students to use the scientific process to determine the health of our Rock Creek watershed. We focus on the water quality in our data collection, but with community professionals' assistance, students are exposed to more than just water quality. Students practice the protocols of water testing in the classroom prior to their field experience so that their data can be as accurate as possible. The handheld computers coupled with the Vernier Lab Pro interface and probes would allow students to go streamside with this equipment and collect accurate data. Using the Palm handheld units, students can enter the data in a spreadsheet when it is collected. They will be able to make field notes electronically. Paper worksheets won't be necessary and classroom time can be saved since students can do the measuring and recording in the field. Science, math, and technology are closely integrated in this project.

The use of the handheld computers allows students the freedom to work where they need to work, including outside the classroom. These units would also allow smaller group work so all students can work with the equipment and be part of the process. Beyond the water quality project, there are numerous lab investigations for earth science that involve using probes, such as, magnetic field sensors to explore magnetism and search for iron ore, temperature probes for differential heating or seasons and angle of insolation, pH sensors to detect soil pH and acid precipitation, and motion detectors to map the room (ocean floor). Lab data and graphs can be synchronized to a classroom computer and then reports printed. Being able to have reports with a good visual representation of the data, plus the data analysis, results and conclusions adds depth to the quality of student work.

The use of the probes with the handheld units gives students the opportunities to explore beyond the classroom. The handheld units will facilitate the flexibility that a computer in the classroom or in a computer lab can not. In any activity that involves data collection, the handheld computers can allow student groups to share their data and build a larger data base to analyze.

Using these handheld computers can improve the fundamental abilities to do scientific inquiry such as using technology and mathematics to improve investigations and communications. This is basic to our National Science Education Standards. Our students will also need to work in a technological world. As educators we need to provide the opportunities for them to develop the thinking skills needed to function well in this every changing world.

Qwest Foundation for Education Grant Expenditure Plan
(Standard IFARMS Budget Format)

Activity	100 Salaries	200 Benefits	300 Contractual Agreements	400 Materials and Supplies	500 Capital Objects	**TOTAL**
1. PalmOne Tungsten T5				15@$400 ea.		$6000
2. PalmOne Tungsten T5 case				15 @ $40 ea.		$600
3. Vernier package: multi-connector cable; cradle; software				15@ $70 ea.		$1050
4. Vernier workshop at Beaverton, OR: ~1300 round trip miles: $.31/mi 3 days food workshop cost for one day						 $403 $ 90 $50
5. Idaho Science Teachers Conference, Oct 2005, Pocatello: ~240 round trip miles: $.31/mi 2 days food registration Lodging (2 night)						 $74 $50 $75 $150
TOTAL						$8542